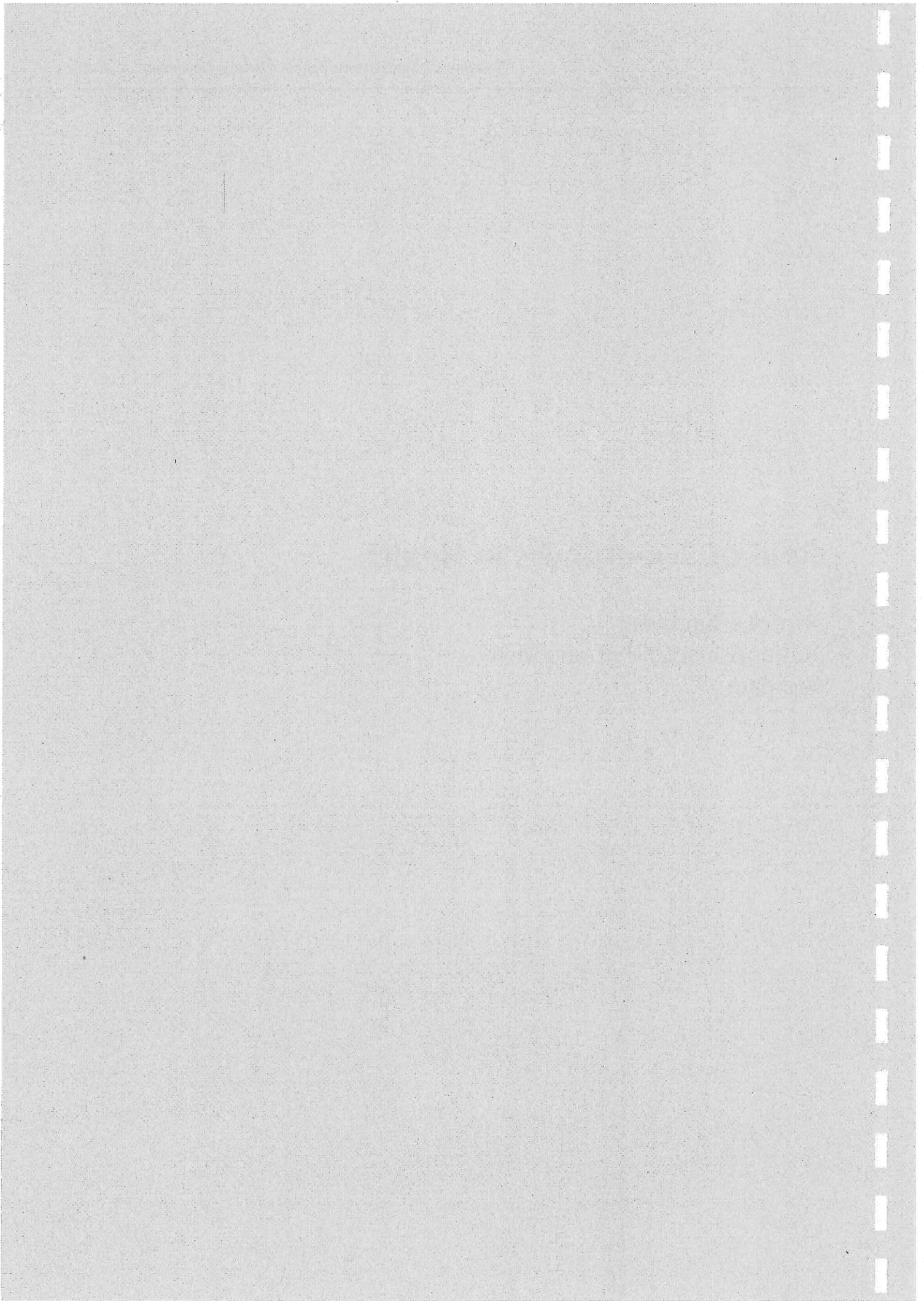


Role of Sweeteners in Health

Prof. Le Bach Mai
National Institute of Nutrition
Vietnam



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Role of sweeteners in health

Assoc. Prof. Lê Bach Mai MD., PhD – NIN
MSc. Lê Hong Dung - NIN

What are low calorie sweeteners?

- Low calorie sweeteners are ingredients that are many times sweeter than sugar (sucrose)
- The calorie content varies from zero to 4 kilocalories per gram, but all deliver very few calories in practice because they are added to products in only tiny amounts
- Low calorie sweeteners are typically found in soft drinks, desserts, dairy products, confectionery, chewing gums and hot chocolate drinks

Sweetness and energy of sweeteners

Substitut du sucre	Rôle	Gout-sucré relatif (par rapport au sucre) 1/2	Energie (kcal/g)**
Sucre (saccharose)	Nombreux	1	4
Acésulfame K		200	0
Aspartame		180 - 200	4***
Cyclamate		30 - 50	0
Néotame		7 000 - 13 000	0
Saccharine		300 - 500	0
Glycyrrhizine		30 - 50	0
Stévia (glycosides de steviol)		200 - 480	0
Sucralose		600	0
Thaumastine		2 000 - 3 000	4***
Alitame		0.1	2
Polydextrose	Agents de charge	0	2
Lactitol		0.5	2,4
Maltitol		1,0	2,4
Mannitol		0,7	2,4
Sorbitol		0,5 - 1,0	2,4
Erythritol		0,6 - 0,8	0
Xylitol		1	2,4
Pectine	Gomme/Agents épaississants	0	2
Amidon		0	4
Guar		0	2

Sweetness of sweeteners

Table: Low-Calorie Sweeteners At-A-Glance.

Sweetener	Date Approved	Sweeter Than Sugar	Brand Name(s)
Ace-K	1988	200x	Sunett®, Sweet One®
Aspartame	1981	180x	NutraSweet®, Equal®, Others
Neotame	2002	7,000x	n/a
Saccharin	Years prior to 1958	300x	Sweet 'N Low®, Sweet Twin, Sugar Twin®, Others
Stevia	2008	200x	Truvia™, Pure Via™, Sun Crystals®
Sucralose	1998	600x	Splenda®

Sources: *Comprehensive Reviews in Food Science and Food Safety*, IFT, 2006. *Food and Chemical Toxicology*, 2008

Weight management

- Scientific evidence suggests that low calorie foods and drinks contribute to people's weight management efforts
- A recent study found that substitution of added sugar by sweeteners in carbonated soft drinks has beneficial effects on body mass index (BMI) (*Hendriksen MA et. al, 2011*)
- A review (*A. de la Hunty et al.*), which investigated 16 randomised controlled studies) found that choosing foods and drinks that contain aspartame in place of their regular sugars resulted in reductions in both energy intake and body weight (the estimated rate of weight loss for a 75kg adult was 0.2 kg/week).

Possible health benefits of artificial sweeteners

De La Hunty A, Gibson S & Ashwell M (2006). A review of the effectiveness of aspartame in helping with weight control. *Nutrition Bulletin* 31:115-128

Table 2 Summary of data of studies with weight as an outcome measure

References	Number of study	Length of study	Intervention	BMI	Weight change
No energy restriction Gandy et al. (1997)	13/1719	6 weeks	Subjects in the intervention groups were instructed to use either reduced-fat or reduced-sugar foods instead of usual foods	<30	No significant effect on bodyweight
Nisenth and Rhodes (1995)	16 men	10 days	Subjects were provided with a diet from when about 500 kcal had been either covertly subtracted or substituted by the substitution of aspartame for sucrose	22.6 and 21.7	+0.2 (3 kg for sucrose then aspartame) +0.44 kg for aspartame then sucrose
Purtilo et al. (1982)	6 men	2 > 72 days	Subjects in a metabolic ward were given foods sweetened with either aspartame or sucrose in a crossover study	25.4	+0.8* (sucrose) vs. -0.8 kg (aspartame) *P < 0.05 compared with baseline
Penick et al. (1977)	9	a diet on aspartame vs 5 days on sucrose diet	Subjects in a metabolic ward were given foods sweetened with either aspartame or sucrose in a crossover study	28.30	10.33 (sucrose) vs. 10.10 kg (aspartame)
Razin et al. (2002)	3/120	10 weeks	Overweight people were given food and drinks sweetened with either sucrose or intense sweeteners to incorporate into their diet	26.0/27.6	+1.8 (sucrose) vs. -1.0 kg* (sweetener) *P < 0.001 compared with sucrose group
Reid and Hammerley (1998)	28	1 week	Subjects were given soft drinks sweetened with either aspartame or sucrose to incorporate into their daily diet	Men 22.5/ Women 23.4	No significant effect on weight
Tordoff and Alleva (1990)	30	3 vs 3 weeks	Subjects were given 150 g of soft drinks (each sweetened with either aspartame or high-fructose corn syrup (HFCS) or no hot drink) in a crossover study	25.1 (men) 25.1 (women)	-0.25 (women) and -0.7 kg* (men) on aspartame vs no soft drinks -0.57* (women) and -0.52 kg (men) on HFCS vs no soft drinks *P < 0.05

De La Hunty A, Gibson S & Ashwell M (2006). A review of the effectiveness of aspartame in helping with weight control. *Nutrition Bulletin* 31:115-128

Weight loss diets	16 weeks	12 weeks	16 weeks
Blackburn et al. (1997)	162	59 (13 men, 26 women)	Men 37/28 Women 16/38
Kanders et al. (1988)	16 weeks	12 weeks	Men 16/ Women 16/

Intervention group were given in addition to weight loss diet, aspartame-sweetened puddings or milkshakes and encouraged to use other aspartame-sweetened products

After 15 weeks:
-5.9 (aspartame) vs. -9.8 kg (control)
After 1 year:
+2.6* (aspartame) vs. +5.4 kg (control)
After 2 more years (net weight loss)
-5.1* (aspartame) vs. 0 kg (control)
*P < 0.05 compared with control

Intervention group were given, in addition to weight loss diet, low calorie, aspartame sweetened puddings or milkshakes and encouraged to use diet drinks, etc.

After 12 weeks:
Men:
-33.1 (intervention) vs. -27.0 (control)
Women:
-16.5 (intervention) vs. -12.6 (control)
After 1 year:
Intense association between aspartame and weight regain in men but not in women

The use and consumption of sweeteners have increased sharply over the last twenty years, probably in connection with concerns about double the prevalence of overweight and obesity.

If potential risks of each sweetener are valued at their authorization, no overall assessment of the risks and nutritional benefits of these products had been conducted at EU level to date.

- The use of intense sweeteners replacing sugars causes in most cases a lower short-term energy supply because of their low calorie intake and lack of compensation.
- However, available data cover insufficient duration to ensure the maintenance of the long-term effect.

• Furthermore, studies on weight control in adults as in children have reported contradictory associations. Some observational studies show that the use of intense sweeteners is paradoxically associated with weight gain, without the causality of this association has been established.

• It has not been shown to benefit from the consumption of intense sweeteners on preventing the onset of type 2 diabetes, and patients with diabetes, there is no evidence of benefit of regular consumption of intense sweeteners in substitution of sugar on the glycaemic control.

吃甜食前劑量雖有甜味，不能改吃甜食
但大腦不認為吃甜食，不會 stop eating

Alternative to sugar in diabetes

- According to the World Health Organization (WHO), over 346 million people worldwide have diabetes; type 2 diabetes being the more common
- Artificial sweeteners may be a good alternative to sugar for people have diabetes. Unlike sugar, artificial sweeteners generally don't raise blood sugar levels because they are not carbohydrates

A systematic review on the effect of sweeteners on glycemic response and clinically relevant outcomes

Nastasia Wiebe¹, Raj Padwal¹, Catherine Field², Seth Martin³, Rene Jacobs⁴ and Marcello Tonelli^{1*}

Abstract

Background: The major metabolic complications of obesity and type 2 diabetes may be prevented and managed with dietary modification. The use of sweeteners that provide little or no calories may help to achieve this objective.

Methods: We did a systematic review and network meta-analysis of the comparative effectiveness of sweetener additives using Bayesian techniques, MEDLINE, EMBASE, CENTRAL, and C.A.B. Global were searched to January 2011. Randomized trials comparing sweeteners in obese, diabetic, and healthy populations were selected. Outcomes of interest included weight change, energy intake, lipids, glycated hemoglobin, markers of insulin resistance and glycemic response. Evidence-based terms potentially indicating risk of bias were assessed.

Results: Of 3666 citations, we identified 53 eligible randomized controlled trials with 1126 participants. In diabetic participants, fructose reduced 2-hour blood glucose concentrations by 4.81 mmol/L (95% CI 3.29, 6.34) compared to glucose. Two-hour blood glucose concentration data comparing hypocaloric sweeteners to sucrose or high fructose corn syrup were inconclusive. Based on two 510-week trials, we found that non-caloric sweeteners reduced energy intake compared to the sucrose groups by approximately 250-500 kcal/day (95% CI 153, 866). One trial found that participants in the non-caloric sweetener group had a decrease in body mass index compared to an increase in body mass index in the sucrose group (-0.40 vs 0.50 kg/m², and -1.00 vs 1.60 kg/m², respectively). No randomized controlled trials showed that high fructose corn syrup or fructose increased levels of cholesterols relative to other sweeteners.

Conclusions: Considering the public health importance of obesity and its consequences, the clearly relevant role of diet in the pathogenesis and maintenance of obesity, and the billions of dollars spent on non-caloric sweeteners, little high-quality clinical research has been done. Studies are needed to determine the role of hypocaloric sweeteners in a wider population health strategy to prevent, reduce and manage obesity and its consequences.

- Studies have found that the use of low calorie sweeteners can help people with type 2 diabetes to control their body weight
- Products such as soft drinks, yogurts, desserts and confectionery with low calorie sweeteners play their role in providing different calorie ranges within food categories, as such offering people a wider dietary choice.
- Organisations such as the American Diabetes Association and Diabetes UK point out that products sweetened with low calorie sweeteners can help manage sweet cravings without jeopardising blood glucose levels.

Low Calorie Sweeteners Contribute to Dental Health

- Dental caries are caused by a lack of oral hygiene in which carbohydrates present in the mouth are fermented by naturally occurring bacteria, resulting in the production of acid. Some of this acid can be neutralised by saliva, but, in the absence of good dental hygiene, the remaining acid will cause demineralisation of the teeth and result in caries.
- Low calorie sweeteners cannot be metabolised by oral bacteria to form acids. Therefore, they do not contribute to tooth decay. If you have a full meal, other components of the food can still contribute to tooth decay, so oral hygiene remains important

- The use of intense sweeteners replacing sugars causes in most cases a lower short-term energy supply because of their low calorie intake and lack of compensation.
- However, available data cover insufficient duration to ensure the maintenance of the long-term effect.
- It has not been shown to benefit from the consumption of intense sweeteners on preventing the onset of type 2 diabetes, and patients with diabetes, there is no evidence of benefit of regular consumption of intense sweeteners in substitution of sugar on the glycemic control.

Low Calorie Sweeteners Contribute to Dental Health

- Low calorie sweeteners can be used to improve the palatability of toothpastes, mouthwashes and fluoride supplements, thereby encouraging greater use. Indeed, the European Food Safety Authority (EFSA) has approved the claim that chewing gum with low calorie sweeteners helps maintain tooth mineralisation and neutralise acids

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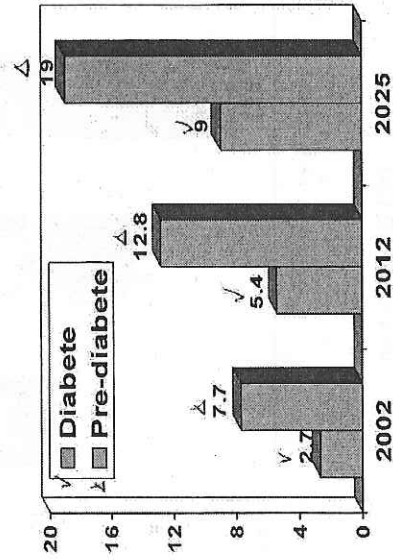
Safety of sweeteners

- All of the low calorie sweeteners allowed for use by Codex have been subjected to rigorous safety testing.
- The use of low calorie sweeteners, like all other food additives, is governed by national food safety authority, such as VFA
- During the safety assessment performed by JECFA, an Acceptable Daily Intake (ADI) is established for each low calorie sweetener. The ADI is a guide to the amount of a low calorie sweetener that can be safely consumed on a daily basis throughout a person's life-time. It is calculated as a fraction (normally one hundredth) of the amount that has been shown to be safe in animal models. Studies in EU confirm that the amount of low calorie sweeteners actually consumed is below the ADI

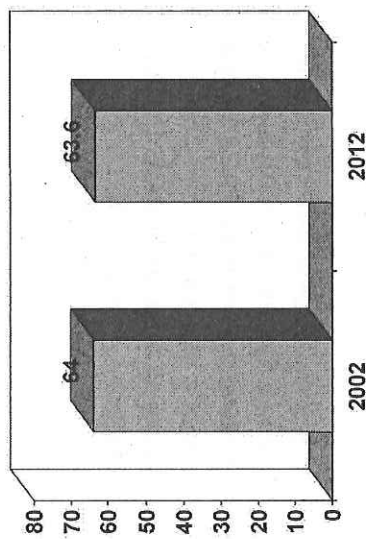
Safety of sweeteners

- During the safety assessment performed by JECFA, an Acceptable Daily Intake (ADI) is established for each low calorie sweetener. The ADI is a guide to the amount of a low calorie sweetener that can be safely consumed on a daily basis throughout a person's life-time. It is calculated as a fraction (normally one hundredth) of the amount that has been shown to be safe in animal models.
- Studies in EU confirm that the amount of low calorie sweeteners actually consumed is below the ADI

Prevalence of diabetes and pre-diabetes
in Viet Nam (%)



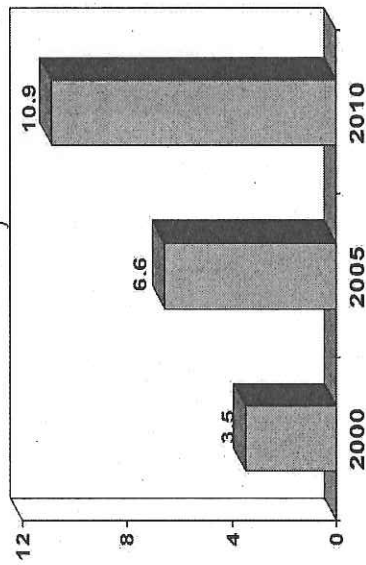
Proportion of patients with undetected diabetes in Viet Nam (%)



how to use sweeteners (Viet Nam)

Prevalence of overweight & obesity (BMI ≥ 25) in Viet Nam (%)

Obesity increase 特別是小孩子 (<5歲)



Regulation of sweeteners in Viet Nam

- Circular No. 08/2015/TT-BYT provides the guidelines for the management of food additive, including sweeteners
- The import, export, production and use of sweeteners are also control by the "National technical regulation on sweeteners" – QCVN 4-8 : 2010/BYT. The list comprises 5 sweeteners for use in Viet Nam.

Recommendations

ANSES highlights the lack of relevant data on the potential benefits of the consumption of sweeteners in the context of a yet wider and former use of them in the food part.

It stresses the need to conduct further research on both benefits on nutritional risks associated with the consumption of sweeteners, particularly:

- In children, work on the development of taste, food preferences and food intake control;
- General population, work related to weight control.
- Specific populations (pregnant women, children, diabetics, regular consumers) have not been enough work. It is therefore necessary to further investigate the risks associated with the use of intense sweeteners in these populations.

Recommendations

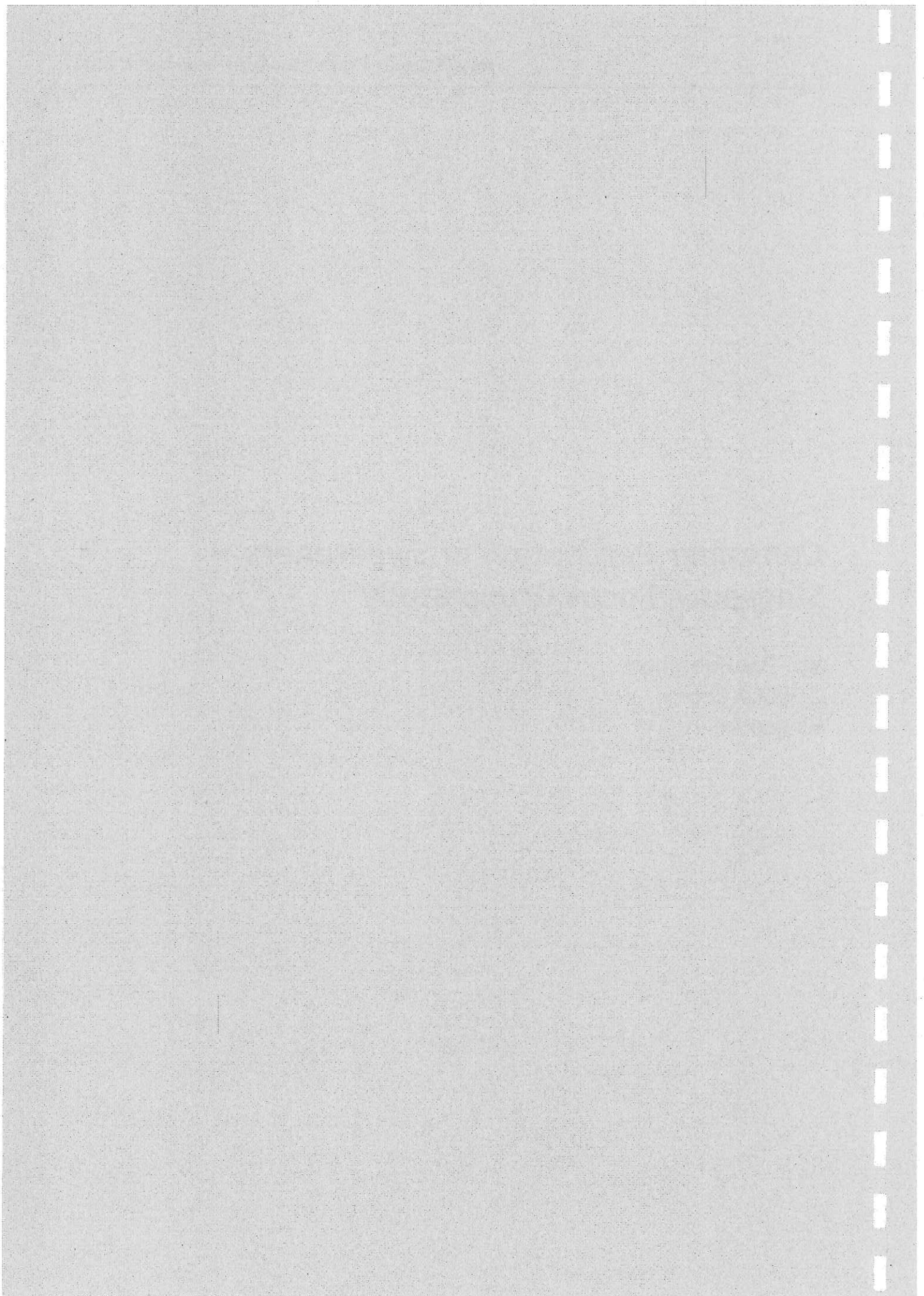
Finally, in a context of nutrition policy where one of the priority objectives is the reduction of sugars intake in the general population, ANSES considers that:

1. There is no conclusive evidence for encouraging, as part a public health policy, substitution of sugar by sweeteners.
2. This sugar intake reduction is to be achieved by the overall reduction in the sweet taste of food, and from an early age.
3. Sweetened beverages and sugary drinks do not replace the water consumption.

Thank you!

Consumer Perception of Sweeteners – Singapore Focus Group Study

Ms. Pauline Chan
ILSI SEA Region
Singapore



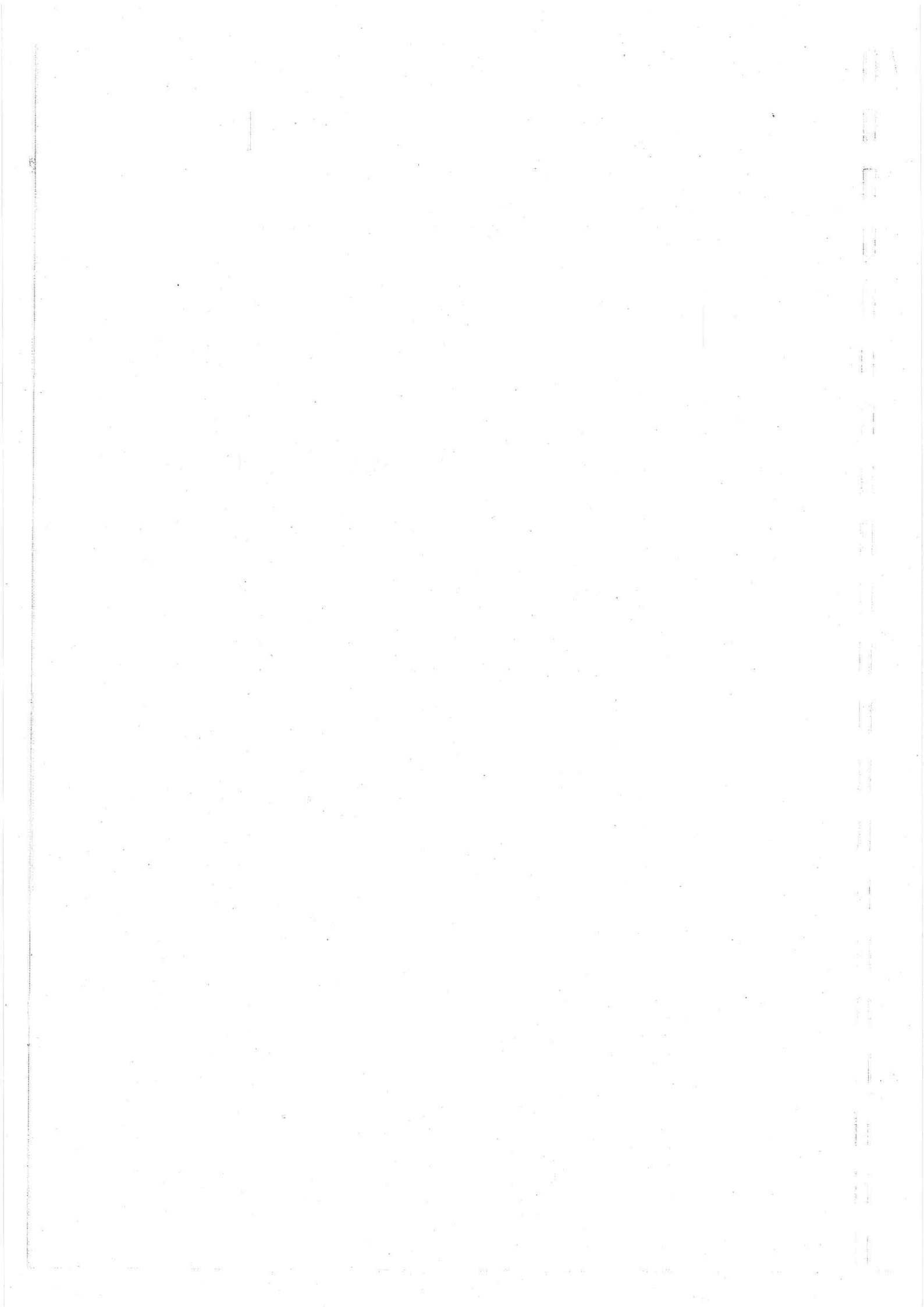
Consumer Perception of Sweeteners – Singapore Focus Group Study

Ms. Pauline Chan
ILSI SEA Region
Singapore

A qualitative research study was recently conducted among consumers in Singapore to understand their knowledge and perceptions related to low and non-caloric sweeteners (LNCS), and at the same time to assess the effectiveness of LNCS-related educational messages in changing consumers' views on sweeteners. A total of 8 focus group discussions (6 respondents in each group) were conducted among consumers between 18-45 years old of different income groups.

Most of the consumers interviewed had little knowledge about how LNCS are made and processed by the body, as well as whether there is a safe intake level. In addition, they also classified LNCS as "artificial" and as potentially having side effects.

After sharing the LNCS messages, consumers appeared to be more open to the use of LNCS. The details of their response to messages related to safety and health effects of LNCS will be shared at this seminar.



Seminar on Sweeteners:
Uses and Safety
December 14, 2015, Hanoi, Vietnam

Consumer Perception of Sweeteners: Singapore Focus Group Study

Pauline Chan
Director, Scientific Programs
ILSI SEA Region



Outline

- Background and Objectives
- Method and Samples
- Results
 - Prevailing knowledge and attitudes towards sweeteners
 - Response to educational messages
 - Recommendations from Study



Background

Little is known about what consumers know and how they feel about sweeteners. In addition, there is currently no study on the effectiveness of educational messages about sweeteners.

Objectives

1. Understand consumer knowledge and perceptions related to sweeteners (LNCS)
2. Assess effectiveness of educational messages in changing consumer views on sweeteners



此研究之甜eners為低 & 非-nutritional sweeteners.

Method and Samples

- Focus groups:
 - 8 groups, 6 respondents per group *marry but no kids*

Segment profile	Youth 18-24 y.o.	Singles/ DINKS 25-34 y.o.	Families with kids 35-45 y.o.
Low-mid income MHI 2,000-4,500	1 group Mixed gender	1 group men 1 group women	1 group women
Mid-high income MHI 4,500+	1 group Mixed gender	1 group men 1 group women	1 group women

Income
(level)

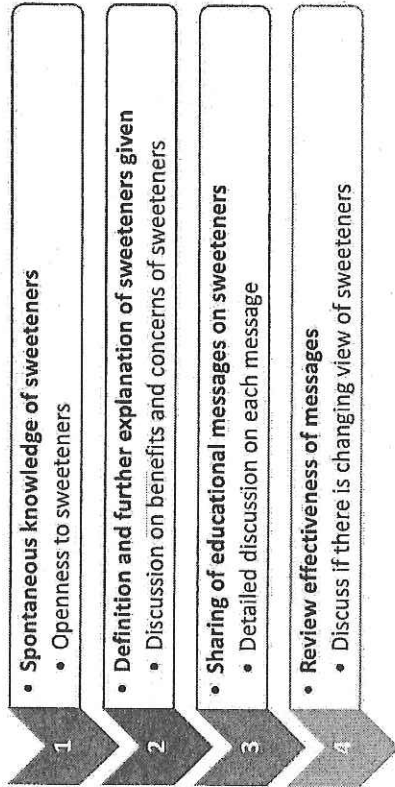
Common criteria:

- Not trained/working in Nutrition or Food Science
- 4 Chinese and 1-2 Indian/Malay in each group

Similar to 研究群分布在 Singapore



Overall Process in Focus Group



Prevailing Knowledge and Attitudes towards Sweeteners

- Most consumers think of sweeteners as sugar or products with sugar. Sugar substitutes are not an immediate association
- In general, sugar is regarded as "bad" and most consumers try to moderate sugar consumption
- Consumers classify sweeteners into natural and artificial/processed. Sugar substitutes are regarded as natural and artificial.
 - natural sugar honey
 - chemical

NATURAL Sweeteners

- Sugar in original state
- From plants
- Eg. sugar, honey

ARTIFICIAL Sweeteners

- Chemicals
- Manufactured in factory
- Eg. LNCS



Perception of Sweeteners as Artificial Raises Concerns

1. Expensive
 - companies just want to make profit (esp. mid-high income youths of 18-24 y.o.)
 2. May lead to addiction; unsure of what is a safe intake level
 3. Do not know side effects (e.g. may have toxins, may affect kidney)
- Increasing concern
-



Changes in Perception after Explanation

- More open to trying sweeteners because they are reassured that:
 1. Sweet yet contain low/no calories
 2. Natural sweeteners exist



Responses to Different Educational Messages

- 1. Sweeteners are reviewed for safety by the AVA and other international regulatory authorities before being approved for use in foods and beverages
- 2. All approved sweeteners can be safely consumed by the general population, including people with diabetes, pregnant women, and children.
- 3. Sweeteners do not cause or increase the risk of cancer. Studies have repeatedly shown that sweeteners do not cause or increase the risk of developing cancer.
- 4. Sweeteners do not cause or increase the risk of other health conditions like seizures, infertility, stomach ailments, possible effects on kidney and liver functions.

Source: International Food Information Council Foundation. Facts about Low-calorie Sweeteners. <http://thiurl.com/IFIC-Sweeteners>

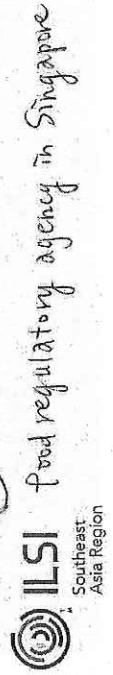
1. Sweeteners are reviewed for safety by the AVA and other international regulatory authorities (like US Food and Drug Authority, European Food Standard Agency) before being approved for use in foods and beverages

- Reasons why impact of this message is limited on other groups, apart from low-mid income families with kids:

AVA approval is given	• AVA approves all products that are allowed to be sold in Singapore
Safe but not "healthy"	• Message only talks about safety (short-term), but might not be "healthy" in the long term
Consumer responsibility	• Consumers' own responsibility to ensure healthiness of food

1. Sweeteners are reviewed for safety by the AVA and other international regulatory authorities (like US Food and Drug Authority, European Food Standard Agency) before being approved for use in foods and beverages

- Works well with families with kids, low-mid income group
 - Are happy to rely on government to make decisions for them
 - AVA has more credibility than international regulatory authorities
- Some consumers across other groups also like this claim as AVA approval is reassuring



1. Sweeteners are reviewed for safety by the AVA and other international regulatory authorities (like US Food and Drug Authority, European Food Standard Agency) before being approved for use in foods and beverages

- Consumers perception between "safe" and "healthy":
 - "Safe" = short-term (e.g. food poisoning)
 - "Healthy" = long-term (e.g. cancer)

<p>"May be safe now but what about in the long term?"</p> <p>18-24 y.o. mid-high income</p>	<p>"Can it be HPB approved?"</p> <p>Single women/DINKS, high-mid income</p>
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2. All approved sweeteners can be safely consumed by the general population, including people with diabetes, pregnant women and children

▪ This message was not so well accepted because of 2 hurdles:

Safety provides only limited assurance

- Similar to fact about AVA approval
- Questions about limit beyond which it ceases to be safe were raised

Statement is too strong and not believable

- Consumers uneasy about safety for pregnant women
- Does not reassure them that baby will not be affected



3. Sweeteners do not cause or increase the risk of cancer. Studies have repeatedly shown that sweeteners do not cause or increase the risk of developing cancer

▪ Message is comforting as cancer is generally a big health concern for consumers

- Puts consumers at ease and overcomes concerns about sweeteners being artificial therefore bad for health
- Some consumers, who do not associate sweeteners with cancer specifically, are surprised but find the message reassuring

▪ Claim of “repeated studies” adds further support

based on several studies



Additional supporting information provided on safer consumption among different subgroups

There have been 5 studies identified by American Diabetes Association based on which they recommend use of non caloric sweeteners instead of sugar as a method to moderate carbohydrate intake to achieve blood sugar level control

- Issues with the research:
- 5 studies is too few
- Scale of the study is not clear
- Focused on Americans; studies on Singaporeans will be more convincing
- Unsure who funds the research

A 2012 review in the Journal of the Academy of Nutrition and Dietetics concluded that consumption of sweeteners does not affect glucose levels in diabetics

- Mixed views:
- More believable than previous statement
- 2012 sounds outdated
- “Journals can be biased”

3. Sweeteners do not cause or increase the risk of cancer. Studies have repeatedly shown that sweeteners do not cause or increase the risk of developing cancer

▪ However, a key issue arises around this message:

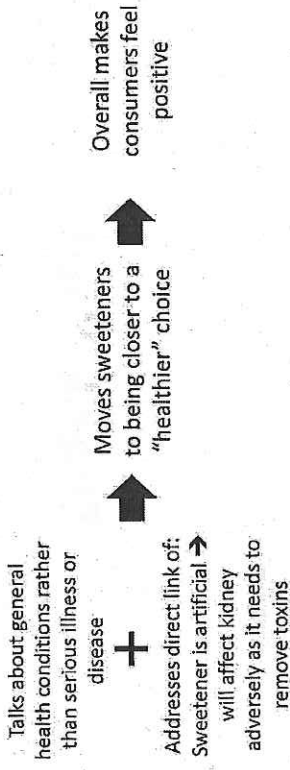
Issues around credibility

- Belief that research views change often
- Consumers do not know specifics of research. Some are skeptical about who is sponsoring the research



4. Sweeteners do not cause or increase the risk of other health conditions like seizures, infertility, stomach ailments, possible effects on kidney and liver functions

▪ **Key benefits that make this message impactful:**



4. Sweeteners do not cause or increase the risk of other health conditions like seizures, infertility, stomach ailments, possible effects on kidney and liver functions

- **Message is interesting - accepted with little resistance**
- **Consumers however seek more clarifications:**
 1. Basis of message claim is not clear- not all health conditions stated are associated with sweeteners
 - Most commonly associated with kidney and liver
 2. Questions about dosage/limit
 3. A few not convinced
 - As long as it is sweet, it will affect some organs



Summary

1. Little knowledge about how sweeteners are made and processed by the body creates a barrier that "sweeteners are artificial and therefore will have side effects"
2. Knowing that "sweeteners are sugar substitutes with low calories and can be of natural sources" creates more openness to trying sweeteners
3. Some groups are more skeptical about sweeteners and the messages around them



Recommendations from Study

1. Address barrier or knowledge gaps of sweeteners

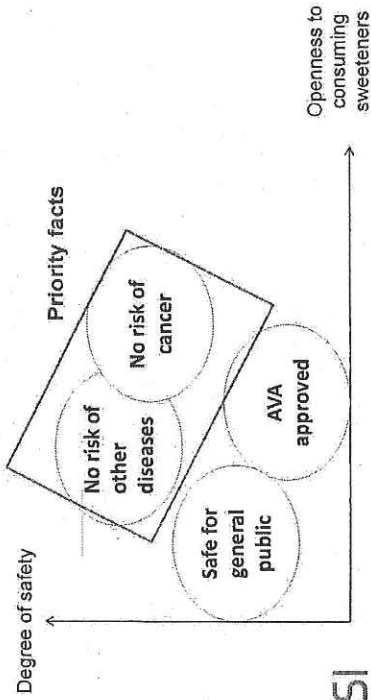
Reassuring Consumers by:

- Providing information on how sweeteners are produced
- Providing information on how the body processes sweeteners



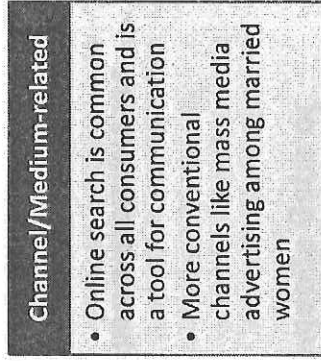
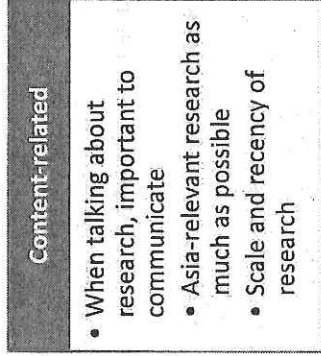
Recommendations from Study

2. Reassure consumers that sweeteners are safe alternatives, both in the short and long term



Recommendations from Study

3. Communicate in a way that is convincing and relevant



Thank You!

SESSION 2

Safety Assessment of Additives and Sweeteners

Chair: Mrs. Tran Viet Nga, Vietnam Food Administration, Vietnam

